WHAT IS CLAIMED IS:

1. A method of measuring the accumulation of antitumor drugs by solid tumors comprising,

administering an antitumor drug labeled with a positron-emitter to a patient having a solid tumor, and

imaging at least part of the patient using PET.

2. The method according to claim 1, wherein the solid tumor is selected from the group consisting of breast, lung, ovarian, gastrointestinal, prostate, sarcoma and head and neck tumors.

3. The method of claim 1, wherein the labeled drug is at least one drug selected from the group consisting of ^{11}C-paclitaxel, ^{11}C-docetaxel, ^{11}C-doxorubicin, ^{11}C-epirubicin, ^{11}C-mitoxantrone, ^{11}C-topotecan, and a drug for the treatment of solid tumors that has been radiolabeled.

4. A method of determining the efficacy of an antitumor drug for treating solid tumors comprising:

administering an antitumor drug labeled with a positron-emitter to a patient having a solid tumor; and

imaging at least part of the patient by PET to measure accumulation of the labeled antitumor drug.

5. The method according to claim 4, wherein the labeled antitumor drug is administered prior to a course of treatment of the patent.

6. The method of claim 4, wherein the labeled antitumor drug is administered during the course of treatment of the patent.

7. The method of claim 4, wherein the labeled drug is at least one drug selected from the group consisting of ^{11}C-paclitaxel, ^{11}C-docetaxel, ^{11}C-doxorubicin, ^{11}C-epirubicin,

^{11}C-mitoxantrone, ^{11}C-topotecan, and a drug for the treatment of solid tumors that has been radiolabeled.

8. A method of measuring the effectiveness of modulators of cellular accumulation mechanisms in tumors comprising:

administering an antitumor drug labeled with a positron-emitter to a patient;

administering a modulator to the patient, and

imaging at least part of the patient by PET to measure accumulation of the labeled antitumor drug.

9. The method of claim 8, wherein the accumulation of labeled antitumor drug is measured before and after administering the modulator to the patient and the levels of antitumor drug accumulation before and after administering the modulator are compared.

10. The method of claim 8, wherein modulator affects an efflux mechanism.

11. The method of claim 8, wherein modulator affects an influx mechanism.

12. The method of claim 8, wherein the labeled drug is at least one drug selected from the group consisting of ^{11}C-paclitaxel, ^{11}C-docetaxel, ^{11}C-doxorubicin, ^{11}C-epirubicin, ^{11}C-mitoxantrone, ^{11}C-topotecan, and a drug for the treatment of solid tumors that has been radiolabeled.

13. A method for measuring the effectiveness of a combination of antitumor drugs comprising:

administering more than one antitumor drug to a patient having a solid tumor, wherein at least one of said antitumor drugs is labeled with a positron-emitter, and

imaging at least part of the patient by PET to measure accumulation of the labeled antitumor drug.

14. The method of claim 13, wherein two antitumor drugs are administered to the patient.

15. The method of claim 13, wherein one of said antitumor drugs is labeled with a positron-emitter.

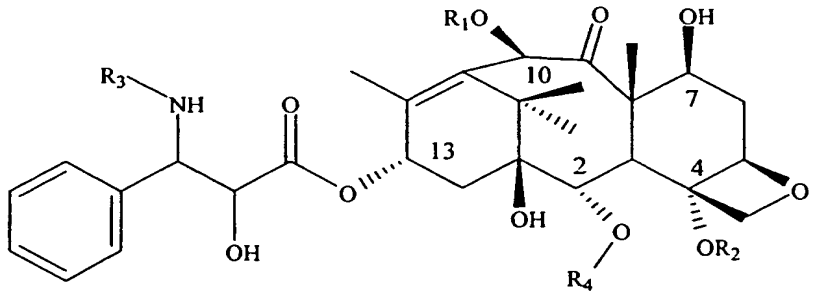
16. The method of claim 13, wherein two of said antitumor drugs are each labeled with a positron-emitter.

17. The method claim 13, wherein a first antitumor drug and a second antitumor drug are administered simultaneously.

18. The method claim 13, wherein a first antitumor drug and a second antitumor drug are administered sequentially.

19. The method of claim 13, wherein the labeled drug is at least one drug selected from the group consisting of ^{11}C-paclitaxel, ^{11}C-docetaxel, ^{11}C-doxorubicin, ^{11}C-epirubicin, ^{11}C-mitoxantrone, ^{11}C-topotecan, and a drug for the treatment of solid tumors that has been radiolabeled.

20. A compound having the formula:



wherein:

R_1 is selected from the group consisting of H, acetate and ^{11}C-acetate;

R_2 is selected from the group of acetate and ^{11}C-acetate;

R_3 is selected from the group consisting of benzoyl, ^{11}C-benzoyl, $-CO_2C(CH_3)_3$ and $-^{11}CO_2C(CH_3)_3$; and

R_4 selected from the group consisting of benzoyl ^{11}C-benzoyl; and

wherein the compound contains at least one atom of ^{11}C.

21. A compound according to claim 20, wherein R_1 is ^{11}C-acetate, R_2 is acetate, R_3 is benzoyl and R_4 is benzoyl.

22. A compound according to claim 20, wherein R_1 is acetate, R_2 is ^{11}C-acetate and R_3 is benzoyl and R_4 is benzoyl.

23. A compound according to claim 20, wherein R_1 and R_2 are acetate and R_3 is ^{11}C- benzoyl and R_4 is benzoyl.

24. A compound according to claim 20, wherein R_1 and R_2 are acetate, R_3 is benzoyl and R_4 is ^{11}C-benzoyl

25. A compound according to claim 20, wherein R_1 is H, R_2 is acetate, R_3 is $-^{11}CO_2C(CH_3)_3$. and R_4 is benzoyl.

26. A compound according to claim 20, wherein R_1 is H, R_2 is ^{11}C-acetate, R_3 is $CO_2C(CH_3)_3$ and R_4 is benzoyl

27. A compound according to claim 20, wherein R_1 is H, R_2 is acetate, R_3 is $- CO_2C(CH_3)_3$ and R_4 is ^{11}C-benzoyl.

28. A method of synthesizing the compound according to claim 20, comprising the steps of:

reacting 10-deacetylpaclitaxel with a chlorotrialkylsilane to yield a protected deacetylpaclitaxel;

reacting the protected deacetylpaclitaxel with ^{11}C-acetyl chloride to yield a radio-labeled silyl protected deacetylpaclitaxel; and

removing the protecting groups to produce ^{11}C-paclitaxel.

29. A method of synthesizing the compound according to claim 20, comprising the step of:

reacting paclitaxel primary amine with ^{11}C-benzoyl chloride to produce ^{11}C-paclitaxel.

30. A method of synthesizing the compound according to claim 20, comprising the step of:

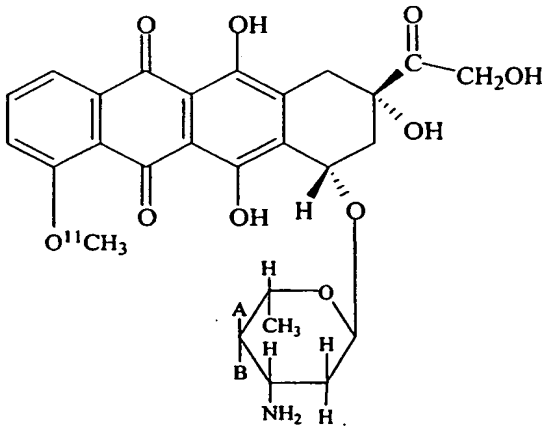
reacting docetexal primary amine with ^{11}C-di-tert-butyl dicarbonate to produce ^{11}C-docetaxel.

31. A method of synthesizing the compound according to claim 20, comprising the steps of:

reacting paclitaxel primary amine with ^{11}C-di-tert-butyl dicarbonate to give ^{11}C -10-acetyldocetaxel; and

reacting the ^{11}C -10-acetyldocetaxel with hydrogen peroxide to produce ^{11}C-docetaxel.

32. A compound having the formula:



wherein one of A or B is H and the other of A or B is OH.

33. The compound of claim 32, wherein A is H and B is OH.

34. The compound of claim 32, wherein A is OH and B is H.

35. A method of synthesizing the compound according to claim 32, comprising the steps of:

protecting the amino group of doxorubicin with an amino protecting group to yield an amino-protected doxorubicin;

protecting the hydroxy groups of the amino-protected doxorubicin with one or more hydroxy protecting groups to yield a fully protected doxorubicin;

demethylating the aromatic methoxy group to yield a 4-OH protected doxorubicin;

reacting the 4-OH protected doxorubicin with ^{11}C-methyl iodide; and

removing the amino and hydroxy protecting groups to produce ^{11}C-doxorubicin.

36. The method according to claim 35, wherein the amino protecting group is 9-fluorenylmethyl, the hydroxy protecting group is benzoyl, and the fully protected doxorubicin is demethylated using boron trichloride.

37. A method of synthesizing the compound according to claim 32, comprising the steps of:

protecting the amino group of epirubicin with an amino protecting group to yield an amino-protected epirubicin;

protecting the hydroxy groups of the amino-protected epirubicin with one or more hydroxy protecting groups to yield a fully protected epirubicin;

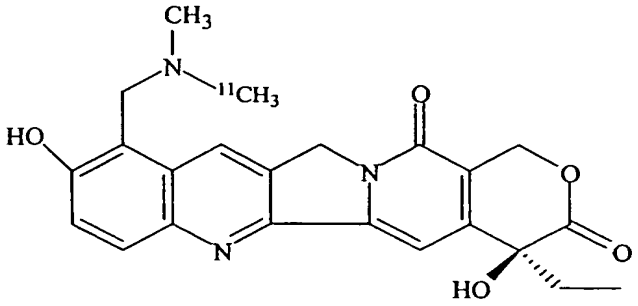
demethylating the aromatic methoxy group to yield a 4-OH protected epirubicin;

reacting the 4-OH protected epirubicin with ^{11}C-methyl iodide; and

removing the amino and hydroxy protecting groups to produce ^{11}C-epirubicin.

38. The method according to claim 35, wherein the amino protecting group is 9-fluorenylmethyl, the hydroxy protecting group is benzoyl, and the fully protected epirubicin is demethylated using boron trichloride.

39. A compound having the formula:



40. A method of synthesizing the compound according to claim 39, comprising the step of:

reacting N-desmethyl topotecan with ^{11}C-methyl iodide to produce ^{11}C-topotecan.